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On the Structure and Probable Affinities of Cerionites dactylioides Owen

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ON THE STRUCTURE AND PROBABLE AFFINITIES OF CERIONITES DACTYLIOIDES OWEN.

BY S. CALVIN.

In his *Report of a Geological Exploration of a part of Iowa, Wisconsin, and Illinois*, made under instructions from the Secretary of the Treasury of the United States in the autumn of the year 1839, Dr. David Dale Owen describes and figures a small fossil from the "Coralline beds of the Upper Magnesian Cliff Limestone of Iowa and Wisconsin," under the name of *Lunulites? dactioloides*. The report was printed in June, 1840, and was reprinted with some additions and emendations in 1844. The fossil in question, *Lunulites? dactioloides*, is described briefly, as follows, on page 68: Truncated spherical, with five or six sided cellular depressions in rows around the circumference, like those on a thimble, one inch and a quarter in circumference." The illustration of the species, Figure 4, Plate XIII, exhibits a fossil with a spherical surface marked by rounded pits arranged quincuncially. The pits are relatively large and separated from each other by thick walls. Owen's figure is indeed a very imperfect illustration of the fossil as we now know it; and were it not for the text which describes the cellular depressions as five or six sided, and the fact that no other spheroidal fossils having the surface marked by polygonal depressions are known from the horizon of the Niagara limestone, the forms we have studied might never have been identified with Owen's species. The identification was first made by Meek and Worthen who, in the Geology of Illinois, Vol. III, page 345, give the results of their study of this species under the name of *Pasceolus? dactylioides* Owen. They recognize the difference between the form they describe and Billings' genus *Pasceolus*, but without deciding the zoological relationship of the form under consideration, and even without settling the question of whether it was an external or internal cast, they propose for it the new generic name of *Cerionites*.

In the fourth volume of the Geology of Wisconsin, page 267, Prof. R. P. Whitfield effects another change in the spelling of the specific name, and discusses the characters of the species in question under the head of *Cerionites dactyloides* Owen, although in the description of Plate XIII, Whitfield allows the name to stand as *Cerionites dactiloides*.

Concerning the specific name I think it must be evident that Owen intended to use a term implying, not that the fossil described was *like a finger*, but that it was *like a thimble*—something to put on the finger. The word that comes nearest to standing for thimble may be spelled with our Roman letters *dactulios* from which we may derive dactilioides, the form in which Owen probably intended to write it, or *dactylioides*, the more correct spelling employed by Meek and Worthen.

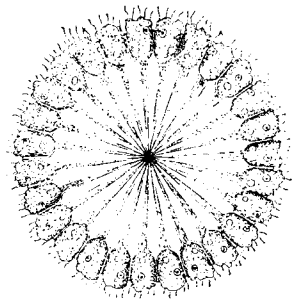
Cerionites is found in Iowa about the middle of the Niagara limestone, being most plentiful at the horizon represented by the exposures near Maquoketa, in Jackson county. The matrix is a buff or yellowish dolomite, and the fossil itself as usually found, and as it was seen by Owen and Messrs. Meek and Worthen, is a more or less compressed sphere, from three-fourths of an inch to an inch and a half in diameter, composed of the same material as the matrix, and marked on the surface by shallow pits that are usually six sided, though the number of sides may vary from four to seven. The pits vary also in size, although the relations are not absolutely constant; still in general the larger pits belong to the larger individuals. A small tubular opening descends from the bottom of each pit to the center of the sphere. For a good illustration of the usual appearance of the fossil the reader is referred to the Geology of Illinois, volume III, plate 5, figure 2c.

The appearance of the fossil varies with the conditions under which it was preserved. There are also differences of appearance due to variations in modes of growth. Meek and Worthen recognize an upper and a lower side differing in respect to size and character of the pits. Whitfield speaks of a point of attachment. From a study of a large series of individuals we may now demonstrate that the normal colonies of *Cerionites*, when alive, were spherical, unattached bodies, in which the structures now indicated by the pits were similar in size and other characteristics over the entire surface. On the surface of a number of our specimens we have a series of prisms, about a tenth of an inch in length, with their inner rounded ends resting in the concave pits. These prisms, which correspond in number and size with the pits of the surface, as we usually see it, are very loosely attached to the body of the fossil and to each other; indeed, it is evident that between the individual prisms, and between the ends of the prisms and the bottoms of the pits, their laminæ of some sort have been dissolved out. Moreover, the prisms are of the same material as the matrix, and also of the same material as the fossil itself.

Now, in all our dolomites the fossils are usually in the form of casts. Chitinous and calcareous structures are dissolved away, and the places these structures occupied are, in a majority of instances, vacant; what was hollow in the original fossil has been filled with the material of which the embedding rock is constituted, and what was solid is simply an unoccupied space. Bearing these facts in mind we can easily restore the original solid parts of *Cerionites*. All the solid parts of our present fossils of this genus from Iowa were hollow. The vacant spaces between the prisms referred to, and between the rounded ends of the prisms and the bottom of the shallow pits were occupied by these laminæ of chitinous or calcareous matter. The small opening leading from the bottom of each pit toward the center of the sphere was occupied by a slender cone that was probably hollow, especially at its larger outer end. The spaces now occupied by the prisms were hollow and bounded by their walls, constituting the laminæ already mentioned; so that we would get, as a result of our efforts to restore the solid parts of the original organism, a number of shallow, polygonal coherent cups, with thin chitinous walls, so arranged as to enclose a spherical space, each cup sending toward the center of the sphere a slender radial tube or rod of the same chitinous material. The tubes or rods were certainly very delicate at the center of the stem, at which point they were probably all more or less intimately united and from which they diverged as radii, one to the bottom of each cup.

Cerionites, therefore, was a colony of individualized units of some sort. Each separate individual was surrounded by thin chitinous or calcareous theca, that took

the form of a shallow polygonal calyx. Each was united to the center of the sphere, the point at which growth began, and from which it proceeded outward along radial lines, by a slender thread of protoplasm which was also inclosed in a delicate chitinous sheath. The colony was free, and doubtless moved through the water with the graceful rolling motion that characterizes colonies of *Uvella* and *Synura*. The movements of the still more beautiful and much more familiar *Volvox globator* will convey to users of the miscroscope a correct idea of a mode of locomotion I fancy they might have witnessed, without the aid of the "tube," in all the sheltered covers of the Upper Silurian period where Cerionites congregated. It is probable that the skeleton was chitinous rather than calcareous. It was flexible enough to undergo extensive deformation without breaking, and exposed parts were frequently decomposed before the entire structure was embedded.



Ideal section of Cerionites (original).

The zoological position of *Cerionites* is less clear than the structure of its skeletal parts. It is scarcely probable, however, that the zooids that inhabited the delicate chitinous thecæ, attained the rank of *Hydrozoa*. It seems more probable that they were rather gigantic *Protozoa*. At all events I know of nothing to render such a view improbable. Some of our modern protozoa are about as large as the smaller individuals of *Cerionites*. Individuals of the genus *Noctiluca* are often a twentieth of an inch in diameter, and the gigantic *Actinosphæria* to which I called attention in the *American Naturalist* for 1890 (Vol. 25, page 934), are even larger. Many of the *Protozoa* secrete a chitinous case or lorica. Many, as *Uvella* and *Synura*, live in spheroidal colonies in which the individuals are attached by bands of more or less modified protoplasm, to the center of the sphere, and in *Synura*, each zooid is contained in a separate membranous sheath which takes the form of calices here conceived to have been present in *Cerionites*. Figures 12 and 13, plate i of Kent's *Manual of the Infusoria*, representing *Megosphæra planula*, approximate very closely the figures that must be made to express my conception of a living colony of *Cerionites*. The figure accompanying this paper is simply an attempt to represent diagramatically an ideal section of such a colony.

NATURAL GAS AND OIL IN IOWA.

BY CHARLES ROLLIN KEYES.

During the past decade no geological question has awakened more popular interest than that of the possibility of finding natural gas and petroleum within the limits of the State. In a number of places shallow borings have yielded from time to time sufficient quantities of natural gas for local use. At some of these places the citizens are kept constantly in a feverish state of expectancy which is ever ready to